(12) **EUROPEAN PATENT APPLICATION**

(72) Inventor: **Sanchez de Leon Rodriguez Roda, Juan Antonio**
46012 Valencia (ES)

(74) Representative: **Canadell-Isern, Roberto**
Travesera de Gracia 30, 1 C
08021 Barcelona (ES)

(54) **Conveyor system for sorting according to weight and optical properties**

(57) The purpose of the invention is a fruit and vegetable conveyor for classification by weight and electro-optical parameters, of the monorail type, with the fruit-carrying elements coupled to a transporting chain formed by turning biconic rollers.

Each carrier is composed of two bicones (1) joined by a frame (2), and the set is embedded in a transporting chain (3) by means of an anchoring part (4) with two projections (5) which is able to be vertically displaced.

As the frame (2) slides along the guides, these transmit the weight to charge cells the signal of which is electronically analyzed to discount the tare and obtain the weight of each piece of fruit.

The bicones (1) turn due to friction of their polished ends against a motor belt, and the speed and turning direction of the bicones (1) depend on the relation between the lineal speeds of the motor belt and the transporting chain (3).
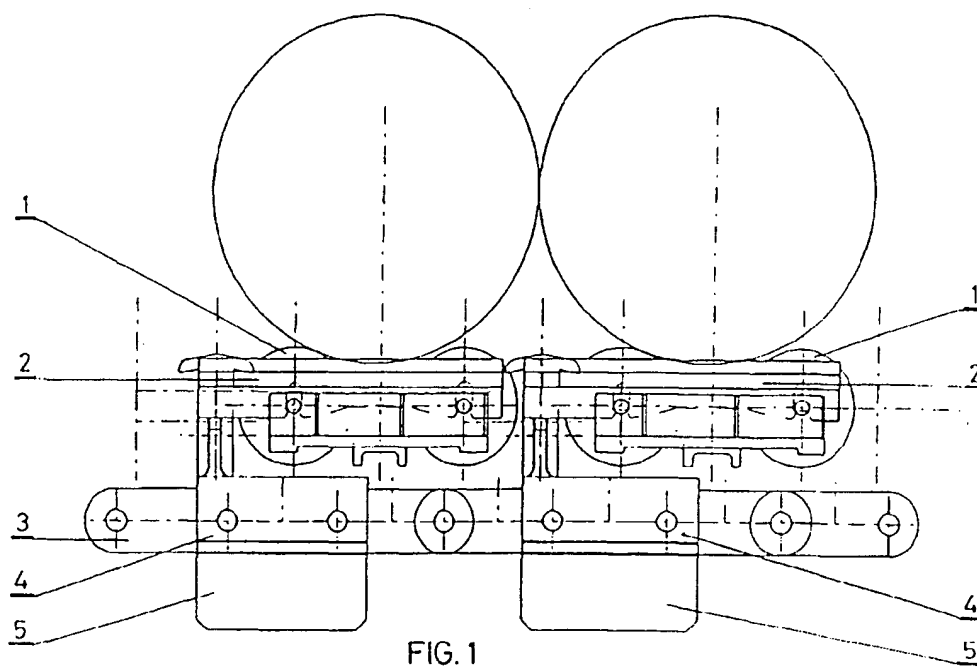
FIG. 1

EP 1 083 008 A1

Description

[0001] The purpose to which the invention that protects this patent refers consists of a fruit and vegetable conveyor for classification by weight and electro-optical parameters.

[0002] It consists of a continuous monorail conveyor whose transporting elements of the fruit or vegetables facilitates the successive and uninterrupted performance of the following functions:

a) Unit weighing of each piece of fruit

b) Its suitable positioning with the longitudinal axis (peduncular) transversally arranged in the direction that the conveyor advances

c) Continuous rotation of the fruit in the direction and at the ideal speed so that all its surface can be seen when it passes through the field of vision of the electro-optical parameter detection cameras

d) Coordinated regulation of the advance speeds of the conveyor and rotation of the fruit so that said visualization can be completely produced with the best performance of the transport

e) Unmistakable identification of each piece of fruit according to its characteristics so that it can its unloading can be put in order in the corresponding point, according to the preestablished classification

f) Automatic unloading in the adequate place, by means of overturning the transporting element

HISTORY

[0003] In the field of transporting fruit and vegetables for classification according to their physical characteristics, numerous methods with different ideas and purposes are known.

[0004] Thus, for example, there are those that exclusively use mechanical means (pairs of rollers of variable distance, nets, divergent flex, etc.), which are limited to classifying by diameter, give rise to knocks that damage the fruit and do not facilitate statistical information.

[0005] Electronic classifying conveyors are also known, with weight detecting cups that are supplied by a biconic roller elevator on which an electro-optical system is installed to detect the parameters.

[0006] These conveyors have problems in transferring the fruit from the biconic feeder to the weight detecting cup, as it limits the speed (and, as a result, the performance) of the set and, furthermore, it has to be very precise in order to correlate the identification of each piece of fruit in the biconic feeder and in the weighing cup so that the central computer can decide without error the corresponding unloading point.

[0007] Finally, monorail electronic classifiers are also known, in which the elements that carry and subsequently unload the fruit in the suitable place are coupled to a longitudinal transporting chain, without causing a transfer amongst the transport means in the interval between the weighing and the optical parameter detection of the fruit.

[0008] Some conveyors of this type which are able to weigh are shaped in such a way that the fruit passes underneath the optical parameter detector cameras, propelled by biconic pairs that make it turn so that the greatest part of the surface comes into the field of vision of the cameras.

[0009] The arrangement of the conveyor when loading occurs throughout the transporting chain according to the sequence bicone-fruit-bicone-fruit, etc., underneath which there a fruit ejecting system that operates when the fruit passes through the suitable unloading point.

[0010] The size of the fruit to be classified is limited by this type of conveyor, both as regards its maximum diameter (due to the separation between the axes of every two consecutive bicones So that the pieces of fruit housed in each one do not touch each other) and its minimum diameter (so that the pieces are completely rotated under the cameras).

DESCRIPTION OF THE INVENTION

[0011] The aim of the invention purpose of this patent consists in the elimination of the known disadvantages characteristic of the conveyors for classifying fruit, described above, and has been conceived and designed taking into account this priority purpose.

[0012] To this effect, the elements and functional means described below have been designed, which develop the functions conferred to them in said descriptions, according to the following detail:

- Weighing function: The conveying element of the fruit is composed of two bicones joined by a conveying frame that, during a section of its advance course, slides on guides that transmit the weight of the fruit-carrying set to charge cells which record it and send it to the central computer.

[0013] The set formed by the two bicones and the conveying frame are engaged in the transporting chain by means of an anchoring part that has two projections that slide into a groove, thus permitting that the set has a degree of freedom of movement in the vertical direction which facilitates elevation of the set as the frame slides along the guides, transmitting the stress to the charge cells on which it rests.

[0014] The weight of each piece of fruit is obtained by means of a tare prior to the different weight components of the fruit (guides, frame, bicones), filtering of the signal and its electronic analysis.

- Rotating function: The bicones are revolving to make the fruit that rests on them turn, so that the entire surface is shown to the optical parameter detection cameras.

[0015] The turning speed is variable and able to be regulated, as the bicones have a polished surface at their ends which rest on motor belts, preferably trapezium, which make them turn due to friction and the lineal speed of which is controlled electronically.

[0016] Consequently, the turning speed and direction of the bicones depend on the relation between the lineal advance speeds of the motor belts and the support chain of the bicones and may be voided when these are equal.

[0017] Control of the turning speed of the bicones is very important, as by means of this compliance with other functions is obtained, such as:

- Positioning function: In general, it is of interest that the turning axis of the fruit coincides with its peduncular axis (ideal line that joins the peduncle and the barycenter) and that this is transversally positioned in the advance direction of the conveying element.

[0018] With this arrangement, the peduncle or calyx of the fruit remains on one side of the field of vision of the cameras so that it is not confused with a superficial defect (stain, knocking, etc.)

[0019] The required positioning is achieved by making the fruit turn at the suitable speed by means of regulating the turning speed of the bicones.

- Visualization function: The lineal advance speed of the transporting chain has to be combined with the turning speed of the bicones in order to achieve that the fruit makes a 360° turn within the field of vision of the cameras and, therefore, that these completely see its surface.
- Identification function: For correct classification, it is required that each piece of fruit is unmistakably identified by its physical characteristics (weight, sizes, superficial optics).

[0020] At the same time, it is required that each piece of fruit occupies a conveying element for this singularity, that is, that it is positioned between each pair of bicones joined by a frame. This is obtained by means of an adjusted supply (in the region of 80% of the maximum capacity of the conveyor) and regulation of the speed and turning direction of the bicones.

- Unloading function: The conveying elements formed by each pair of bicones and its frame can be optionally tilted from one side to another of the transporting chain by means of displacing a support ramp operated by an electromagnet at the corresponding unloading point for its classification, according to the characteristics of the fruit, obeying the signal issued by the control computer.

BRIEF DESCRIPTION OF THE FIGURES

[0021] The following figures complement the description of the invention and facilitate the interpretation of its formal, structural and functional characteristics, in which different aspects of a preferred performance of a fruit and vegetable conveyor, for classification by weight and electro-optical parameters and which constitutes the purpose of this patent, are schematically represented.

[0022] In said figures:

[0023] Figure 1 represents, on a side elevation, two carrying elements (sets of two bicones and a frame), each one loaded with a piece of fruit and embedded in the transporting chain.

[0024] Figure 2 shows, on a floor view, the transporting chain with the parts than anchor the carrying sets.

[0025] Figure 3 shows, on a floor view, the two carrying sets of figure 1, unloaded, unset and separated from the transporting chain, showing the carrying frame that joins the two bicones.

[0026] Figure 4 is a front elevation view of a complete bicone, with the part anchored to the transporting chain, tilted for lateral unloading of the carried fruit. Unloading may be carried out, alternatively, towards the opposite side of the chain, with no more than adopting the symmetrical axis as the turning axis, as shown in the upper part of the anchoring element.

[0027] Figure 5 shows a front elevation view of a bicone without the anchoring element and representing the carrying frame sectioned.

[0028] Figure 6 is a front elevation of a bicone, showing the sectioned frame and the arrangement of the branches projecting out of the anchoring element to the transporting chain.

DESCRIPTION OF A PREFERRED PERFORMANCE

[0029] In order to clearly show the nature and scope of the advantageous application of the fruit and vegetable conveyor for classification by weight and electro-optical parameters that constitute the purpose of this invention, the following is a description of its structure and operation. Reference is made to the figures that, on representing a preferred performance of said object for information purposes, should be considered in their widest sense and not limiting of the application and content of the invention.

[0030] The conveyor is of the monorail type consisting of elements that carry the fruit and unload in the suitable point which are coupled to a continuous longitudinal transporting chain made up of turning biconic rollers that make the fruit turn so that all its surface is shown before the optical parameter detecting cameras.

[0031] The conveying element of the fruit is composed of two bicones (1) joined by a carrying frame (2), forming a set that is embedded in the transporting chain (3) by means of anchoring element (4) that has two projections (5) which slide in a groove, giving the set certain

freedom of movement in the vertical direction.

[0032] This displacement capacity facilitates that, on the frame (2) sliding along guides in a section of its advance path, these guides transmit the weight of the fruit conveying set to charge cells.

[0033] On previously knowing the tare of the different components of the weight of the fruit (guides, frame, bicones), these cells issue a signal which, after being filtered and electronically analyzed, records the weight of each piece of fruit.

[0034] The turning bicones (1) of the carrying element have a polished surface at their ends which rest on motor belts, preferably trapezium, which make them turn due to friction and the lineal speed of which is controlled electronically.

[0035] The turning speed and direction of the bicones depend on the relation between the lineal advance speeds of the belts and the transporting chain (3) by which, through their regulation the movements of the bicones (1) are controlled and on which the following depend: complete visualization of the surface of the fruit by the optical parameter detecting cameras; unmistakable identification of each piece of fruit; and the preferential choice of the peduncular axis of the fruit as the rotation axis, as well as its correct positioning in the transversal direction as regards the advance direction of the transporting chain.

[0036] Once the nature and functional scope of the invention have been described, as well as a preferred way of putting it into practice, it is recorded that in said invention the materials, forms, sizes and, in general, all accessory or secondary characteristics that do not alter, change or modify its main aspects may be variable. This is included in the following claims.

Claims

1. Fruit and vegetable conveyor for classification due to weight and electro-optical parameters, of the monorail type, including the elements that carry the fruit and unload it at the suitable place, coupled to a continuous longitudinal transporting chain made up of turning biconic rollers that make the fruit turn so that its surface is presented before the optical parameter detecting cameras. It is basically characterized by the fact that the fruit-carrying element is composed of two bicones (1) joined by a carrying frame (2) which form a set that is embedded in the transporting chain (3) by means of an anchoring part that has two projections that slide into a groove, thus permitting that the set has a degree of freedom of movement in the vertical direction which facilitates elevation of the set as the frame slides along the guides, transmitting the stress to the charge cells on which it rests. These cells, on previously knowing the tare of the different weight components of the fruit (guides, frame, bicones), issue a signal

which, after being filtered and electronically analyzed, records the weight of each piece of fruit.

2. Fruit and vegetable conveyor for classification by weight and electro-optical parameters, according to claim 1, characterized basically by the fact that the turning bicones (1) of the carrying element have a polished surface at their ends that rest on motor belts, preferably trapezium, which make them turn due to friction and the lineal speed of which is controlled electronically. The result is that the turning speed and direction of the bicones (1) depend on the relation between the lineal advance speeds of the belts and the transporting chain (3) through which, by means of their regulation, the movements of the bicones (1) are controlled and on which the following depend: complete visualization of the surface of the fruit by the optical parameter detecting cameras; unmistakable identification of each piece of fruit; and the preferential choice of the peduncular axis of the fruit as the rotation axis, as well as its correct positioning in the transversal direction as regards the advance direction of the transporting chain.
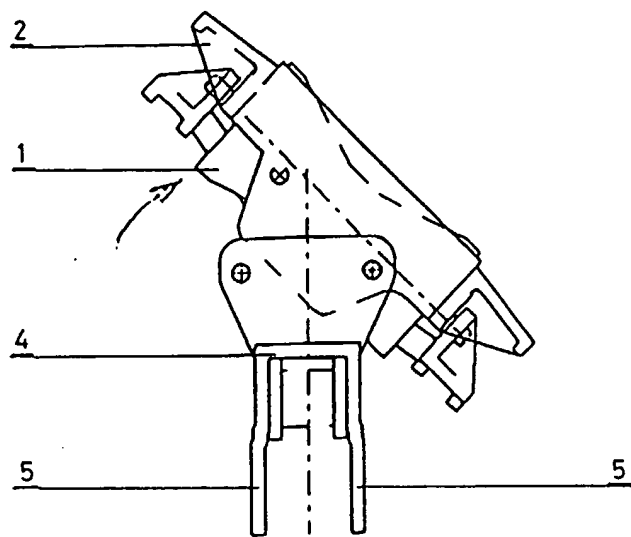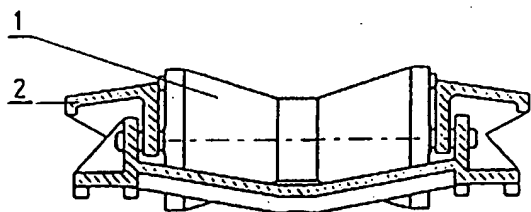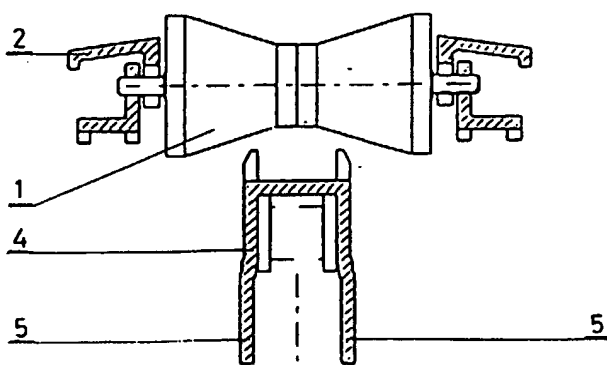
FIG. 1

FIG.2

FIG. 3
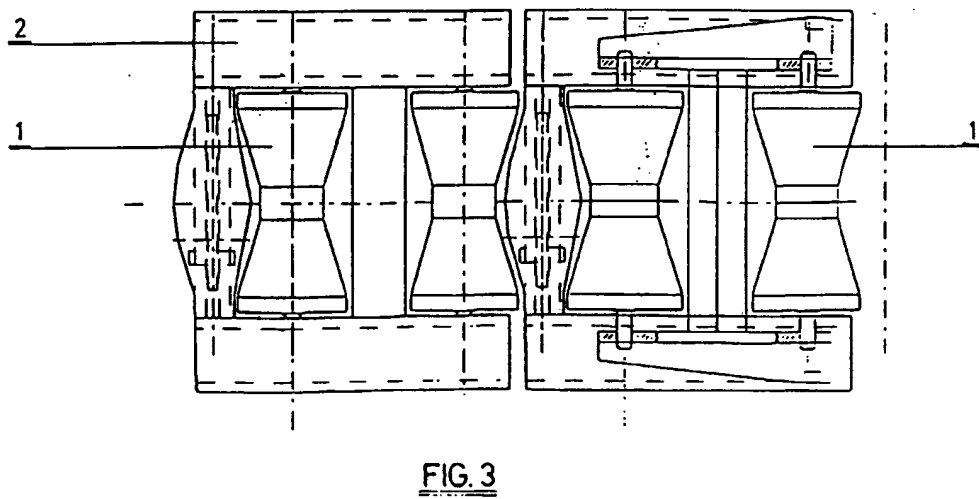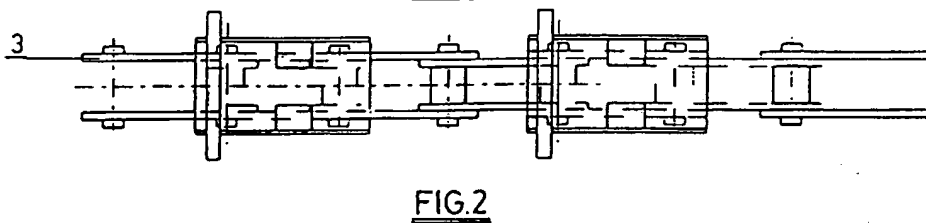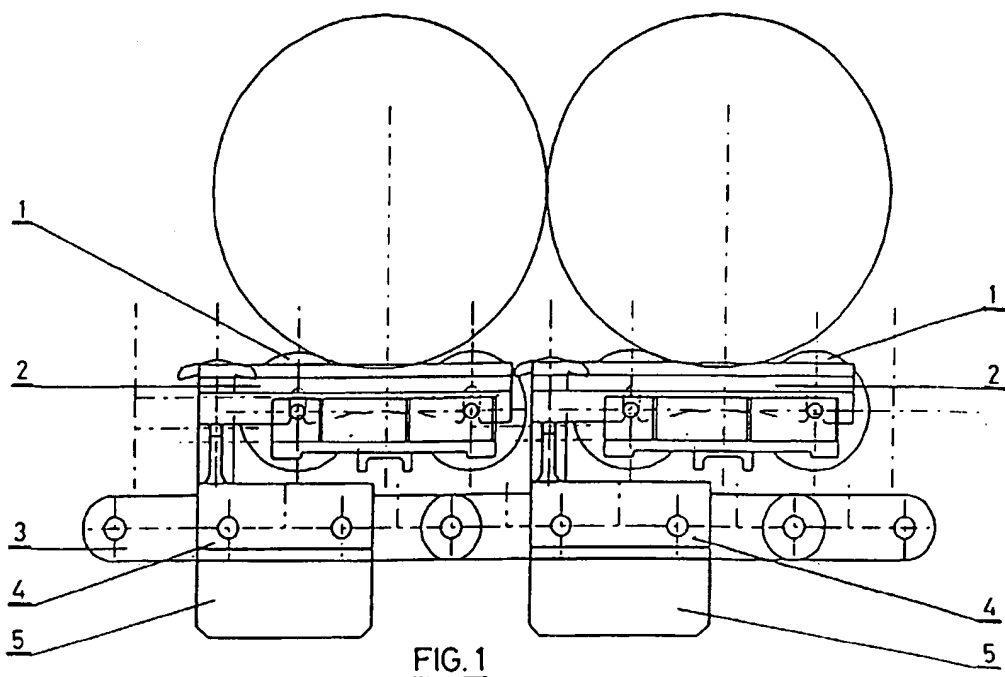
FIG.4

FIG.5

FIG.6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 99 50 0159

	DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 267 654 A (LEVERETT WILLIAM H) 7 December 1993 (1993-12-07) * column 5, line 45 - column 7, line 34; figures 1,6 *	1	B07C5/342 B07C5/18
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B07C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 February 2000	Gélébart, Y

CATEGORY OF CITED DOCUMENTS

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ON EUROPEAN PATENT APPLICATION NO.   EP 99 50 0159

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